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ABSTRACT

The Graduate Record Examination (GRE) Aptitude Test has been in use since 1938. In 1975 the GRE Aptitude Test was broadened to include an experimental set of items designed to tap a respondent's recognition of logical relationships and consistency of interrelated statements, and to make inferences from abstract relationships. To test the predictive efficiency of the GRE analytical score as a separate part of the admission process to a graduate program in Educational Psychology, GRE Aptitude scores, sex, and ethnicity of 472 subjects were analyzed. Results showed that the Analytical Score contributed little to the predictive efficiency of graduate school admission when used in combination with the other GRE scores, but was equally useful when used independently. Sex differences were noted only on Quantitative Scores. For foreign and minority groups, other selection criteria influenced admission decisions more than the GRE Aptitude Scores. The findings suggest that the Analytical Reasoning component of the GRE Aptitude Test may provide a way to tap independent thinking and analytical reasoning powers prior to making the admission decision. (JAC)

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THE UTILITY OF THE GRE ANALYTICAL SCORE FOR SELECTION INTO A GRADUATE PROGRAM IN EDUCATIONAL PSYCHOLOGY

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Paper presented at the Annual Meeting of the Southwest Educational Research Association, Austin, TX, Feb. 11-13, 1982.

The Utility of the GRE Analytical Score for Selection into a Graduate Program in Educational Psychology*

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The Graduate Record Examination (GRE) Aptitude Test has become one of the premier examinations in the United States since its inception in 1938-39. It is used to assess the general academic potential of individuals seeking admission to programs of graduate study. Traditionally, the Aptitude Test of the GRE has focused on sampling an individual's verbal and quantitative aptitude. Research has demonstrated that these two constructs are logically and empirically related to successful academic performance in a variety of fields (Powers & Swinton, 1981; Willingham, 1974, 1976; Wilson, 1979).

Since 1972 the GRE has evolved into 19 Advanced Subject Matter Tests as well as the Aptitude Test with its verbal and quantative sections. These tests separately or in combination have been used extensively as important selection criteria for admission to graduate education. Preliminary work was undertaken in 1974 to improve the GRE Aptitude Test by broadening its definition. The purpose was to allow potential graduate students to demonstrate a broader range of skills which include analytical or abstract reasoning skills (Altman, Carlson, & Donlon, 1975). The result of broadening the GRE Aptitude Test's definition was the development and inclusion of an experimental set of items designed to tap a respondant's recognition of logical relationships, consistency of inter-related statements, and to make inferences from abstract relationships (Power &

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Swinton, 1981). Collectively, this new set of experimental items has been labeled Analytical Aptitude, has broadened the definition of academic talent, and purports to measure those fundamental skills needed in graduate study of any kind. Conrad, Trisman, and Miller (1977) have stated that:

> Three scores rather than a single score are provided for several reasons: 1) a multidimensional definition of academic talent will best serve institutions and students in a variety of fields; 2) the three scores - verbal ability, quantitative ability, and analytical ability - are sufficiently independent to be providing complementary information about students; and 3) studies suggest that each score is related to academic performance in differing degrees depending on the field and may differentially improve prediction of graduate school success. (p. 9)

Given the item sets which collectively define Analytical Reasoning of the GRE Aptitude Test, it seems logical to assume that the items relate to an important aspect of graduate education. Powers and Swinton (1980) have demonstrated that an Analytical construct has been introduced into the GRE Aptitude Test and is defined predominantly by three experimental item types which are different from any of the verbal or quantitative item types. These item types have been labeled as analysis of explanations, logical diagrams, and analytical reasoning. At issue in this research is the broad question, "Does the introduction of a multidimensional definition of academic talent enhance the use of the GRE Aptitude Test as a selection divise for admission to a graduate program in Educational Psychology?"

Problem

The more specific purpose of this research was to test the predictive efficiency of the GRE Analytical (A) score as separate part of the process in selection for admission to a graduate program in Educational Psychology. The Department of Educational Psychology at The University of Texas at Austin is a multidimensional department serving a range of students with diverse interests; from an academic to professional orientation. All students are required to follow a basic psychology core of study prior to advancement to candidacy and concurrent with their specialized subject matter interests. Traditionally, G.P.A. and Verbal (V) and Quantitative (Q) Scores of the GRE Aptitude Test have been used in conjunction with several other criteria for admission purposes. A concern of this graduate program is to select the best possible students who appear to have the potential to succeed without being discriminatory against individuals who on the surface do not appear to meet the minimum GRE verbal and quantitative criteria. It appears with the increased multidimensionality of the GRE Aptitude Test, due to the inclusion of an experimental analytical score, precision in selection can be enhanced, especially for a multidimensional-multipurpose graduate program. Thus, it was hypothesized that the Analytical (A) Score of the GRE Aptitude Test would be a more efficient overall predictor for admission to an Educational Psychology Department than either the Verbal (V) or Quantitative (Q) Scores or G.P.A. It was also hypothesized there would be no sex or ethnic A score differences whereas V and Q scores would be different. Support for these hypotheses would suggest that we can be more efficient in our selection of students who are likely to succeed in a graduate program of Educational Psychology and thus potentially reduce graduate student attrition.

Methodology

Graduate Record Examination Aptitude Scores, sex, ethnicity, age, G.P.A., and marital status of 472 subjects who made application to the Department of Educational Psychology at The University of Texas at Austin during spring 1980 and spring 1981 comprised the data base for analysis. Age and marital status were not used as predictors for this investigation since they were irrelevant for our immediate purpose. Examination of these data revealed that approximately 50% of this subject pool made application for admission to the Ph.D. Counseling Psychology Program and the MEd Counselor Education Program. The remainder of the subject pool were applying for admission to four other deparmtnetal specializations: School Psychology, Quantitative Methods and Evaluation, Learning and Motivation, and Human Development and Social Psychology. The size of the sample was felt to be sufficiently large to test the hypotheses posed and allow for a reasonable level of confidence regarding generalizations from these data to be made about future applicants to the Educational Psychology Program. Inspection of student application forms indicated that the geographical distribution of the applicants represented all regions of the United States as well as several foreign nations representing all continents. The nature and extent of this cross-national and cross-cultural influence suggests that these applicants are representative of graduate student applicants to other similar programs in the United States. This enhances the possibility of generalizing these findings to other potential applicants to graduate programs in Educational Psychology. Two basic analytical procedures were used to test the questions of interest: regression analyses to test the predictive efficiency question and analysis of variance to test the sex and ethnic comparisons. The appropriate computer programs documented in the SPSS

Manual (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975) were used to conduct the data analysis.

Results

The predictive efficiency of the Analytical Score for graduate admission when compared to the predictive efficiency of the Verbal Score, Quantitative Score, and G.P.A. was the first question of concern. The dependent variable (i.e., a dummy variable) was whether or not the applicant was admitted to the graduate program in Educational Psychology. A regression analyses on the independent variables (G.P.A., V, Q, and A) yielded an $R^2 = .15$. The R^2 was found to be significant ($p < .0001$) indicating that this combination of independent variables accounted for a significant portion of the variance associated with admissions.

The unique contribution of each independent variable to the accounted for variance is listed in Table 1. As can be seen the Analytical Score adds the least amount of the total accounted for variance where as Quantitative adds most of the variance accounted for in this sample. An examination of the correlation matrix presented in Table 2 suggest that the Analytical and Verbal and Analytical and Quantitative sections of the GRE Aptitude Test have a stronger relationship to each other than do the other variable combinations. One might conclude that while the Analytical Score when used in combination with V, Q, and GPA contributes little to the predictive efficiency of admission to graduate school that independently the Analytical Score can be useful as an independent predictor about as well as Verbal or Quantitative when they are unavailable or as we shall see later when examining foreign student scores when one or the other of the traditionally used scores are questionable. It must be cautioned that the

Analytical Score used in this study is derived from an experimental test. Revisions to the Analytical sub-set of the GRE Aptitude Test which were instituted in October of 1981 (GRE Newsletter #34, April 1981) now include analytical reasoning and logical reasoning item sets. Analysis of explanations and logical diagrams item sets which are included in the scores used in this study have been omitted due to short-term practice and test-familiarization effect. Powers and Swinton (1981) also found that while there was a definable analytical dimension to the Aptitude Test with the inclusion of the new items, the current experimental test was highly related to other (V and Q) factors.

Insert Tables 1 & 2 About Here

That there would be no sex or ethnic differences on Analytical Scores whereas Verbal and Quantitative Scores would be different was a second question of concern. The data presented in Table 3 and Figure 1 provides some insight to this question. Sex differences are noted only on Quantitative Scores. Males in each ethnic group regardless of admission status scored higher than did females. The largest mean difference is noted between admitted White males and females and the denyed minority group. It is interesting to note that minority female admits are the only group whose mean verbal score exceeded their male counterparts. A similar pattern of males scoring higher is observed with the mean Analytical Score with one exception. Foreign and minority female denyed groups scored higher than their male counterparts. These apparent differences suggest that in general males score higher than females on the GRE Aptitude Test. A second observation suggests that white males and females score about the same on each of their respective sub-tests whereas the foreign and minority groups are more varied

in their score patterns. One could conclude that for the white group sex does not influence selection so long as their Aptitude Test Scores are sufficiently high whereas for the foreign and minority groups other selection criteria influence the admission decision to a greater extent than do the GRE Aptitude Test Scores.

Insert Table 3 and Figure 1 About Here

Earlier it was noted that A scores had a stronger relationship to V or Q scores when used in combination than did the two traditional scores to each other. Also, in some circumstances, one or the other of the two traditional scores might be in question. This certainly appears true for foreign student applicants in this study. Their V scores regardless of admission status are exceptionally depressed while the Q scores appear to be among the highest for all other applicants. Thus, if admission decisions are based upon V and Q there is a possibility that erroneous decisions will be made. Or, as may be the case with this sample, decisions may be made on the bases of limited information. A similar problem, though not quite so extreme, can be inferred with regard to the score pattern among minority male admits (see Figure 1). This poses a question and often a dilemma for admissions committees. What combination of scores will yield the best possible information for decision making when using GRE Aptitude Test data? It would appear from the data presented in Table 2 that the A score would be approrpiately paired with V or Q for decision making, assuming one wishes to use at least two of the three scores (the traditional combination has been two, V and Q) for prediction as well as yielding the most information. The paired combinations for the two highest scores by sex, ethnicity, and admission status

are presented in Table 4. Examinations of these combinations suggests that the only group for whom the A score is not a good predictor are the minority male admits and denys! Obviously, for this sample, Q scores outweigh admission decisions for all groups except white and minority female admits and denys. It appears the Analytical Reasoning Score deserves strong consideration as a predictor for admissions in these particular situations.

Insert Table 4 About Here

Conclusions

The hypotheses posed in this investigation were not supported to the extent predicted. However, given the fact that the Analytical Scores used in this investigation were derived from experimental items, there is some reason to believe that the revised Analytical sub-test will yield usable data for admission decisions to graduate Educational Psychology programs. Further, it would seem that precision of decision making can be enhanced with the addition of this new component of the GRE Aptitude Test. Verbal fluency and quantitative skill mastery are certainly prerequisite to success in research-oriented graduate programs. However, graduate education is more than this, at least from one point of view. It also includes independent thinking and analytical reasoning powers if one assumes these behaviors are necessary to high intellectual activity and are expected to continue beyond the formal education domain. It would seem that the Analytical Reasoning component of the GRE Aptitude Test, as it has been revised, will provide a way to tap this potential prior to making the admission decision.

In no way has this investigation attempted to predict graduate school success. This has yet to be done with these subjects and until completed we

must continue to be cautious about our findings. However, Willingham (1976) noted that being concerned about "selection of graduate students is of far greater concern now than in the past since many more students are involved" (p. 5). We can add that the potential increase of student applicants have come at a time in history when graduate programs are not expanding in size and resources; in fact, many are hard-pressed to maintain their current levels, and may even be reducing their size. These facts make the selection issue more critical.

Finally, while this study falls short of definitive answers to particular questions concerning admissions, the results are in keeping with the GRE Board Research Committee's recommendations for increased institutional studies of this instrument (Willingham, 1976). This was our intent: to contribute to the body of local institutional research. As more studies similar to this one are undertaken, questions concerning validity, methodological issues, and success criteria among others will be addressed. Only then will we improve selection criteria guidelines from which everyone benefits.

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Table 1

R^2 for Each Independent Variable by Order of Contribution

Independent Variable	R^2	R^2 Change
GPA	.0219	.0219
Quantitative	.1175	.0955
Verbal	.1512	.0337
Analytical	.1516	.0004

Table 2

Correlation of Independent Variables

	GPA	V	Q	A
GPA	---	.19	.11	.24
V		---	.28	.62
Q			---	.54
A				---

Table 3

$\bar{X}$ & SD for 1980 and 1981 Ss
Admission Status x Sex x Ethnicity

		Admit				Deny				
		Male		Female		Male		Female		P
GRE Verbal										
W*	$\bar{X}$	612.50	(64)	611.70	(94)	545.91	(93)	542.57	(109)	
	SD	85.88		85.24		87.16		101.98		
F	$\bar{X}$	443.55	(6)	383.64	(11)	354.29	(7)	329.29	(14)	< .0001 Eth.
	SD	148.55		102.30		93.96		67.19		< .0001 A/D
M	$\bar{X}$	446.25	(8)	532.31	(13)	452.00	(10)	427.50	(16)	
	SD	85.85		96.45		102.29		106.24		
GRE Quant.										
W	$\bar{X}$	634.38	(64)	573.51	(94)	545.48	(93)	513.57	(109)	
	SD	73.42		79.33		80.60		102.16		< .007 Sex
F	$\bar{X}$	661.67	(6)	619.09	(11)	567.14	(7)	571.43	(14)	< .0001 Eth
	SD	136.74		135.97		157.13		156.00		< .0001 A/D
M	$\bar{X}$	516.25	(8)	479.23	(13)	457.00	(10)	385.63	(16)	
	SD	105.96		56.93		119.08		101.06		
GRE Analytical										
W	$\bar{X}$	627.11	(45)	615.29	(70)	557.07	(75)	545.61	(82)	
	SD	73.41		69.62		92.57		101.95		< .0001 Eth
F	$\bar{X}$	546.67	(6)	469.09	(11)	360.00	(6)	492.31	(13)	< .0005 A/D
	SD	125.80		85.02		70.14		105.68		< .0006 Sex x Eth x A/D
M	$\bar{X}$	425.00	(8)	516.25	(8)	446.25	(8)	451.00	(10)	
	SD	110.71		89.27		116.98		124.49		

*W = White F = Foreign M = Minority. Number of cases in parenthesis.

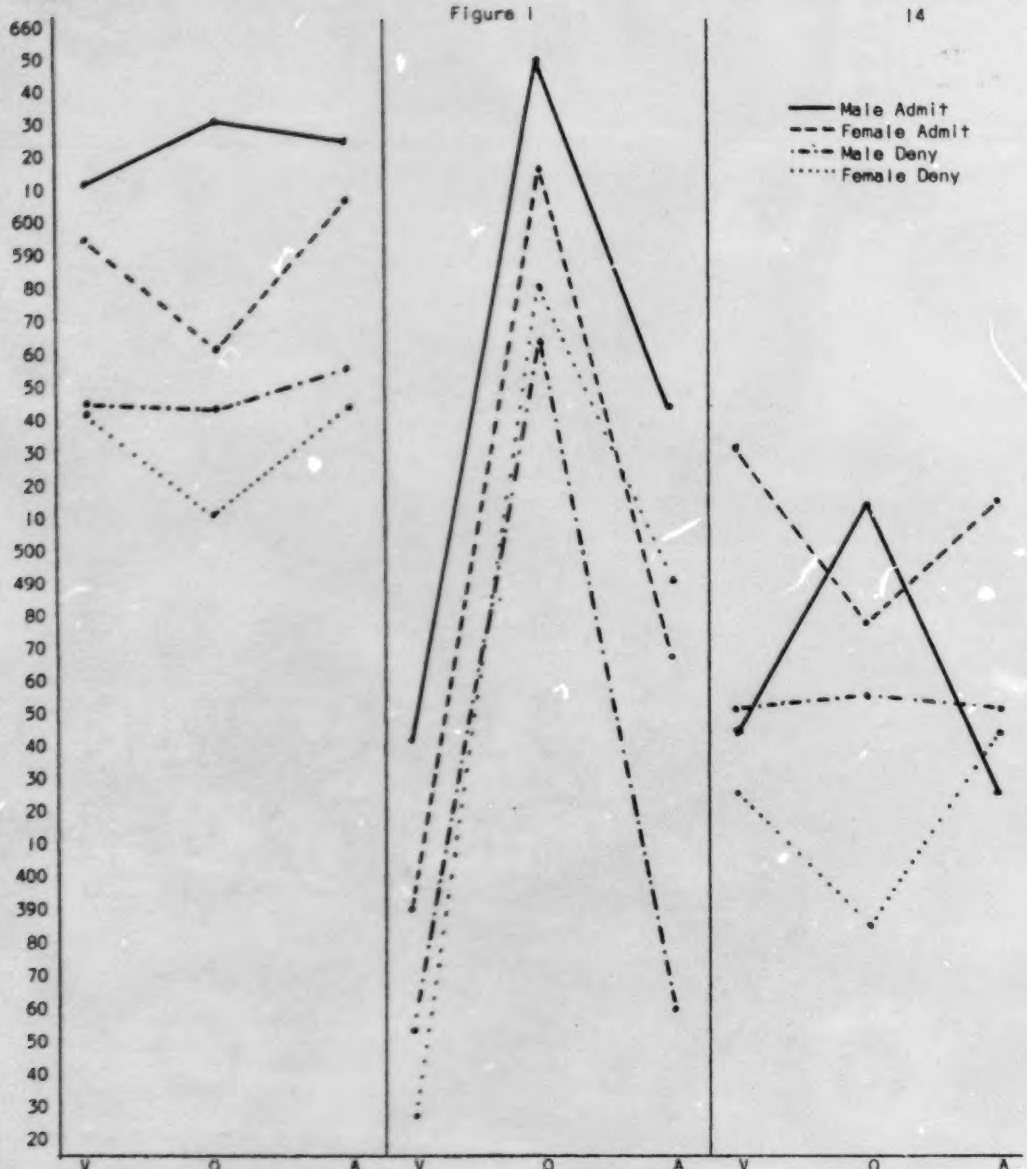
NOTE: The size of N for A does not correspond to V and Q due to the fact that not all applicants reported an A score.

Table 4

Paired GRE Score Combination

	Admit	Deny
White male	Q,A	A,Q
White female	A,V	A,V
Foreign male	Q,A	Q,A
Foreign female	Q,A	Q,A
Minority male	Q,V	Q,V
Minority female	V,A	A,V

Figure 1



N Admit M	64	64	45	6	6	6	8	8	8
Deny F	94	94	70	11	11	11	13	13	8
N Admit M	93	93	75	7	7	6	10	10	8
Deny F	109	109	82	14	14	13	16	16	10